

What is claimed is:

1. A material for a thermal fuse element wherein said material has an alloy composition in which Sn is larger than 25% and 60% or smaller, Bi is larger than 12% and 33% or smaller, and In is 20% or larger and smaller than 50%.
5
2. A material for a thermal fuse element wherein said material has an alloy composition in which Sn is larger than 25% and 60% or smaller, Bi is larger than 12% and 33% or smaller, and In is 20% or higher and smaller than 45%.
- 10 3. A material for a thermal fuse element wherein 0.1 to 3.5 weight parts of one, or two or more elements selected from the group consisting of Ag, Au, Cu, Ni, Pd, Pt, Sb, Ga, and Ge are added to 100 weight parts of an alloy composition of claim 1.
- 15 4. A material for a thermal fuse element wherein 0.1 to 3.5 weight parts of one, or two or more elements selected from the group consisting of Ag, Au, Cu, Ni, Pd, Pt, Sb, Ga, and Ge are added to 100 weight parts of an alloy composition of claim 2.
- 20 5. An alloy type thermal fuse wherein a material for a thermal fuse element having an alloy composition in which Sn is larger than 25% and 60% or smaller, Bi is larger than 12% and 33% or smaller, and In is 20% or larger and smaller than 50% is used as a fuse element.
- 25 6. An alloy type thermal fuse wherein a material for a

thermal fuse element having an alloy composition in which Sn is larger than 25% and 60% or smaller, Bi is larger than 12% and 33% or smaller, and In is 20% or higher and smaller than 45%.

5 7. An alloy type thermal fuse wherein a material for a thermal fuse element in which 0.1 to 3.5 weight parts of one, or two or more elements selected from the group consisting of Ag, Au, Cu, Ni, Pd, Pt, Sb, Ga, and Ge are added to 100 weight parts of an alloy composition of claim 5 is
10 used as a fuse element.

8. An alloy type thermal fuse wherein a material for a thermal fuse element in which 0.1 to 3.5 weight parts of one, or two or more elements selected from the group consisting of Ag, Au, Cu, Ni, Pd, Pt, Sb, Ga, and Ge are added
15 to 100 weight parts of an alloy composition of claim 6 is used as a fuse element.

9. An alloy type thermal fuse according to claim 5, wherein said fuse element contains inevitable impurities.

10. An alloy type thermal fuse according to claim 6,
20 wherein said fuse element contains inevitable impurities.

11. An alloy type thermal fuse according to claim 7, wherein said fuse element contains inevitable impurities.

12. An alloy type thermal fuse according to claim 8, wherein said fuse element contains inevitable impurities.

25 13. An alloy type thermal fuse according to claim 5,

wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

- 5 14. An alloy type thermal fuse according to claim 6, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.
- 10 15. An alloy type thermal fuse according to claim 7, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.
- 15 16. An alloy type thermal fuse according to claim 8, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.
- 20 17. An alloy type thermal fuse according to claim 9, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.
- 25 18. An alloy type thermal fuse according to claim 10,

wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

5 19. An alloy type thermal fuse according to claim 11, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

10 20. An alloy type thermal fuse according to claim 12, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

15 21. An alloy type thermal fuse according to claim 5, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical
20 case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

22. An alloy type thermal fuse according to claim 6, wherein lead conductors are bonded to ends of said fuse
25 element, respectively, a flux is applied to said fuse ele-

ment, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of
5 said fuse element are bonded to front faces of said disks.

23. An alloy type thermal fuse according to claim 7, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a
10 cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

24. An alloy type thermal fuse according to claim 8,
15 wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of
20 said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

25. An alloy type thermal fuse according to claim 9, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element,
25 ment, said flux-applied fuse element is passed through a

cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

5 26. An alloy type thermal fuse according to claim 10, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical
10 case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

27. An alloy type thermal fuse according to claim 11, wherein lead conductors are bonded to ends of said fuse
15 element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of
20 said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

28. An alloy type thermal fuse according to claim 12, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a
25 cylindrical case, gaps between ends of said cylindrical

case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

29. An alloy type thermal fuse according to claim 13,
5 wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of
10 said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

30. An alloy type thermal fuse according to claim 14,
wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse ele-
15 ment, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

20 31. An alloy type thermal fuse according to claim 15,
wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical
25 case and said lead conductors are sealingly closed, ends of

said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

32. An alloy type thermal fuse according to claim 16, wherein lead conductors are bonded to ends of said fuse
5 element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of
10 said fuse element are bonded to front faces of said disks.

33. An alloy type thermal fuse according to claim 17, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a
15 cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

34. An alloy type thermal fuse according to claim 18, wherein lead conductors are bonded to ends of said fuse
20 element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of
25 said lead conductors have a disk-like shape, and ends of

said fuse element are bonded to front faces of said disks.

35. An alloy type thermal fuse according to claim 19, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.
36. An alloy type thermal fuse according to claim 20, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.
37. An alloy type thermal fuse according to claim 5, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.
38. An alloy type thermal fuse according to claim 6,

wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material
5 selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

39. An alloy type thermal fuse according to claim 7, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and
10 a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

40. An alloy type thermal fuse according to claim 8, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and
15 a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

41. An alloy type thermal fuse according to claim 9, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and
25 a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material

selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

42. An alloy type thermal fuse according to claim 10, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

43. An alloy type thermal fuse according to claim 11, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

44. An alloy type thermal fuse according to claim 12, wherein a pair of film electrodes are formed on a substrate by printing conductive paste containing metal particles and a binder, said fuse element is connected between said film electrodes, and said metal particles are made of a material selected from the group consisting of Ag, Ag-Pd, Ag-Pt, Au, Ni, and Cu.

45. An alloy type thermal fuse according to claim 5, wherein a heating element for fusing off said fuse element

is additionally disposed.

46. An alloy type thermal fuse according to claim 6,
wherein a heating element for fusing off said fuse element
is additionally disposed.

5 47. An alloy type thermal fuse according to claim 7,
wherein a heating element for fusing off said fuse element
is additionally disposed.

48. An alloy type thermal fuse according to claim 8,
wherein a heating element for fusing off said fuse element
10 is additionally disposed.

49. An alloy type thermal fuse according to claim 9,
wherein a heating element for fusing off said fuse element
is additionally disposed.

50. An alloy type thermal fuse according to claim 10,
15 wherein a heating element for fusing off said fuse element
is additionally disposed.

51. An alloy type thermal fuse according to claim 11,
wherein a heating element for fusing off said fuse element
is additionally disposed.

20 52. An alloy type thermal fuse according to claim 12,
wherein a heating element for fusing off said fuse element
is additionally disposed.

53. An alloy type thermal fuse according to claim 13,
wherein a heating element for fusing off said fuse element
25 is additionally disposed.

54. An alloy type thermal fuse according to claim 14, wherein a heating element for fusing off said fuse element is additionally disposed.

55. An alloy type thermal fuse according to claim 15,
5 wherein a heating element for fusing off said fuse element is additionally disposed.

56. An alloy type thermal fuse according to claim 16, wherein a heating element for fusing off said fuse element is additionally disposed.

10 57. An alloy type thermal fuse according to claim 17, wherein a heating element for fusing off said fuse element is additionally disposed.

58. An alloy type thermal fuse according to claim 18, wherein a heating element for fusing off said fuse element
15 is additionally disposed.

59. An alloy type thermal fuse according to claim 19, wherein a heating element for fusing off said fuse element is additionally disposed.

60. An alloy type thermal fuse according to claim 20,
20 wherein a heating element for fusing off said fuse element is additionally disposed.

61. An alloy type thermal fuse according to claim 21, wherein a heating element for fusing off said fuse element is additionally disposed.

25 62. An alloy type thermal fuse according to claim 22,

wherein a heating element for fusing off said fuse element is additionally disposed.

63. An alloy type thermal fuse according to claim 23,
wherein a heating element for fusing off said fuse element
5 is additionally disposed.

64. An alloy type thermal fuse according to claim 24,
wherein a heating element for fusing off said fuse element
is additionally disposed.

65. An alloy type thermal fuse according to claim 25,
10 wherein a heating element for fusing off said fuse element
is additionally disposed.

66. An alloy type thermal fuse according to claim 26,
wherein a heating element for fusing off said fuse element
is additionally disposed.

15 67. An alloy type thermal fuse according to claim 27,
wherein a heating element for fusing off said fuse element
is additionally disposed.

68. An alloy type thermal fuse according to claim 28,
wherein a heating element for fusing off said fuse element
20 is additionally disposed.

69. An alloy type thermal fuse according to claim 29,
wherein a heating element for fusing off said fuse element
is additionally disposed.

70. An alloy type thermal fuse according to claim 30,
25 wherein a heating element for fusing off said fuse element

is additionally disposed.

71. An alloy type thermal fuse according to claim 31, wherein a heating element for fusing off said fuse element is additionally disposed.

5 72. An alloy type thermal fuse according to claim 32, wherein a heating element for fusing off said fuse element is additionally disposed.

73. An alloy type thermal fuse according to claim 33, wherein a heating element for fusing off said fuse element
10 is additionally disposed.

74. An alloy type thermal fuse according to claim 34, wherein a heating element for fusing off said fuse element is additionally disposed.

75. An alloy type thermal fuse according to claim 35,
15 wherein a heating element for fusing off said fuse element is additionally disposed.

76. An alloy type thermal fuse according to claim 36, wherein a heating element for fusing off said fuse element is additionally disposed.

20 77. An alloy type thermal fuse according to claim 37, wherein a heating element for fusing off said fuse element is additionally disposed.

78. An alloy type thermal fuse according to claim 38, wherein a heating element for fusing off said fuse element
25 is additionally disposed.

79. An alloy type thermal fuse according to claim 39, wherein a heating element for fusing off said fuse element is additionally disposed.

5 80. An alloy type thermal fuse according to claim 40, wherein a heating element for fusing off said fuse element is additionally disposed.

81. An alloy type thermal fuse according to claim 41, wherein a heating element for fusing off said fuse element is additionally disposed.

10 82. An alloy type thermal fuse according to claim 42, wherein a heating element for fusing off said fuse element is additionally disposed.

83. An alloy type thermal fuse according to claim 43, wherein a heating element for fusing off said fuse element
15 is additionally disposed.

84. An alloy type thermal fuse according to claim 44, wherein a heating element for fusing off said fuse element is additionally disposed.

85. An alloy type thermal fuse according to claim 5,
20 wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

25 86. An alloy type thermal fuse according to claim 6,

wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

87. An alloy type thermal fuse according to claim 7, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

88. An alloy type thermal fuse according to claim 8, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

89. An alloy type thermal fuse according to claim 9, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

90. An alloy type thermal fuse according to claim 10, wherein a pair of lead conductors are partly exposed from

one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

5 91. An alloy type thermal fuse according to claim 11, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

92. An alloy type thermal fuse according to claim 12, wherein a pair of lead conductors are partly exposed from one face of an insulating plate to another face, said fuse element is connected to said lead conductor exposed portions, and said other face of said insulating plate is covered with an insulating material.

93. An alloy type thermal fuse according to claim 5, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

20 94. An alloy type thermal fuse according to claim 6, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

95. An alloy type thermal fuse according to claim 7, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

96. An alloy type thermal fuse according to claim 8, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

97. An alloy type thermal fuse according to claim 9,
5 wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

98. An alloy type thermal fuse according to claim 10, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

10 99. An alloy type thermal fuse according to claim 11, wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.

100. An alloy type thermal fuse according to claim 12,
15 wherein said fuse element connected between a pair of lead conductors is sandwiched between insulating films.